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CONSTITUTION: Upon application of an IG voltage, a generating voltage regulating means 28 turns a switch 34 ON/OFF based on the battery voltage thus feeding or interrupting the exciting current. At the rising time of generated voltage, a duty factor limiting means 29 limits the duty factor of the switch 34 to restrain power generation. Means 15 for relaxing the restriction of duty factor detects the rising rate of generated voltage after application of IG voltage and when the rising rate is high, a decision is made that the

restriction can be relaxed thus relaxing the restriction. When the rising rate is low, the engine is starting and thereby the restriction is not relaxed.

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(54) OUTPUT CURRENT CONTROLLER FOR GENERATOR IN VEHICLE

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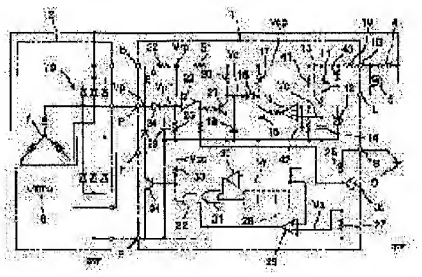

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DETAILED DESCRIPTION

[Detailed description]
[0001]
[Field of the Invention] this invention relates to the output current control unit of the generator for vehicles.
[0002]
[Prior art] the publication-number 173324 [three to] official report will indicate carrying out the predetermined time limit of the rate of a conduction of an exciting-current control switch, suppressing power generation, and increasing the rate of a conduction gradually to a required value after that, if power generation is detected namely,, if it detects that the power generation voltage rose to predetermined level after impression of IG voltage in the output current control unit (it is also called a regulator) of the generator for vehicles
[0003]
[Object of the Invention] However, since predetermined carried out time enforcement of the above-mentioned rate limit of a conduction after the power generation detection irrespective of the engine status, in spite of the status which is unnecessary, the above-mentioned conventional formula maintained the rate limit of a conduction, and had the fault that battery capacity fell.
[0004] For example, when planning the acceleration disposition top of a vehicle by mitigation of an engine load during a vehicle run, only a required short period of time may intercept IG voltage to a regulator during engine rotation or a vehicle run, and IG voltage may be re-impressed to a regulator after that. Moreover, IG voltage may fall temporarily by the ripple of a power generation voltage etc. and in such a case, since IG voltage falls at once and a power generation voltage rises after that, the above-mentioned rate limit (power generation suppression) of a conduction should do only predetermined time after that in the above-mentioned conventional formula -- there was fault that battery capacity fell
[0005] Moreover, at the time of a temporary fall of these power generation voltages, the charge warning lamp lit up for a long time, and there was fault of being troublesome. Moreover, when IG voltage was impressed to a regulator during rotation of a generator, the output state of a generator was inspected and it worked, the above-mentioned rate limit of a conduction, i.e., power generation suppression, there was also fault that check time became long.
[0006] While this invention is made in view of the above-mentioned trouble and the rate limit of a conduction is carried out at the time of engine starting, it sets it as the first purpose to suppress the rate limit of a conduction and to offer the output current control unit of the generator for vehicles which can inhibit shortage of the battery charging current at the time of engine rotation. Moreover, it sets it as the second purpose to offer the output current control unit of the generator for vehicles which can prevent that the rate limit of a conduction described above at the time of the re-elevation after depression of the temporary power generation voltage under engine rotation operates, and the battery charging current runs short.
[0007] Moreover, it sets it as the third purpose to offer the output current control unit of the generator for vehicles which can shorten lighting of the charge warning lamp at the time of a fall of the temporary power generation voltage under engine rotation. Furthermore, it sets it as the fourth purpose to offer the output current control unit of the generator for vehicles which can avoid extension of the check time by the rate limit of a conduction at the time of a check of the power generation status under rotation of a generator.
[0008]
[The means for solving a technical problem] From the battery charged with the generator for vehicles driven with an engine, while IG voltage is impressed as supply voltage through an ignition switch, invention described in the claim 1 A power generation voltage adjustment means to adjust the excitation status of the aforementioned generator for vehicles based on the thermodynamic function about the terminal voltage of the aforementioned battery, In the output current control unit of the generator for vehicles equipped with a power generation limit means to restrict the amount of excitation of the aforementioned generator for vehicles at the time of the power generation voltage standup of the aforementioned generator for vehicles, and to suppress power generation It is characterized by having an amount adjustment means of suppression to detect the speed at which the aforementioned power generation voltage starts, and to change the amount of suppression of the aforementioned power generation according to the detected rate of rise after IG voltage impressing [aforementioned] to the aforementioned power generation voltage adjustment means.
[0009] In what described invention described in the claim 2 in the claim 1, the aforementioned amount adjustment means of suppression is characterized by detecting the aforementioned rate of rise from the aforementioned IG voltage impression point in time based on the aforementioned power generation voltage after predetermined time progress. It is characterized by

invention described in the claim 3 detecting the rate of rise based on time until it sets to what was described in the claim 1 and it reaches a value predetermined [means / amount adjustment / aforementioned / of suppression] in IG voltage impression point in time to a power generation voltage.
[0010] Invention described in the claim 4 has the aforementioned predetermined value higher than the power generation voltage at the time of a cranking in what was described in the claim 1, and it is characterized by being set up lower than the power generation voltage at the time of an idle. In what described invention described in the claim 5 in the claim 1, the aforementioned amount adjustment means of suppression is characterized by canceling a limit of power generation by the power generation limit means.
[0011] A power generation detection means to turn on a charge warning lamp in what described invention described in the claim 6 in the claim 1 when the aforementioned power generation voltage becomes under a power generation detection threshold voltage after IG voltage impression, The aforementioned power generation detection threshold voltage is set as a parvus value until predetermined carries out power generation detection-time progress from IG voltage impression, and after the aforementioned power generation detection-time progress is characterized by having a threshold change means to set the aforementioned power generation detection threshold voltage as a large value.
[0012] Invention described in the claim 7 is characterized by corresponding to the rate of a conduction of a switch means by which the excitation status of a generator is intermittent in the exciting current of a generator in what was described in the claim 1. Hereafter, the vocabulary relevant to this invention is explained. The terminal voltage of a battery is sufficient as the thermodynamic function (only henceforth battery voltage) about the terminal voltage of a battery, and the thermodynamic function interlocked with it is sufficient as it.
[0013] The rectification voltage besides the output terminal voltage of a generator is sufficient as a power generation voltage, or the terminal voltage of the battery with which this rectification voltage is impressed is sufficient as it. In what is intermittent in an exciting current with a switch means, suppression of power generation means restricting the rate of a conduction to a parvus value rather than the rate of a conduction outputted to a switch, in order to obtain the amount of power generation to which it is less than at least 100% of a value, and a power generation voltage adjustment means should make the rate of a conduction of a switch means output based on the thermodynamic function about battery terminal voltage.
[0014] When a detection of the rate of rise of a power generation voltage impresses IG voltage to a regulator, time until a power generation voltage reaches a predetermined value from the time (the time of impressing IG voltage to a regulator is sufficient) of having a fixed relation can distinguish by the comparator etc. whether it is below predetermined time, and also the augend within the predetermined time of a power generation voltage may distinguish with a comparator etc. whether it is beyond a predetermined value. Furthermore, since it depends greatly at the cranking time of a starter, the rate of rise of a power generation voltage can also detect the rate of rise of a power generation voltage by distinguishing whether the parameter relevant to the cranking time of a starter exceeds predetermined level. For example, since battery voltage or IG voltage falls, it can distinguish whether the rate of rise of a power generation voltage is quick or late by time until battery voltage or IG voltage becomes below predetermined level and exceeds predetermined level after that, namely, the inside of the cranking of a starter can distinguish the time of engine starting and engine rotation.
[0015] At the time of the cranking of an engine, the time of the status which the engine is driving by the starter is said. It is defined as adjustment of the amount of suppression as a thing including both of halt of relief of the amount of suppression, and suppression. Moreover, the amount of suppression may be suppression time. In one mode, if the rate of rise of a power generation voltage is comparatively slow, the amount of suppression will be reduced, and as long as it is comparatively quick, you may increase the amount of suppression.
[0016] IG voltage says the voltage impressed to the output current control unit of the generator for vehicles from a battery through an ignition switch. Impression of IG voltage includes the case where it becomes more than predetermined level again, after IG voltage falls below to predetermined level.
[0017]
[An operation and an effect of the invention] A power generation voltage adjustment means performs excitation based on battery voltage after impression of IG voltage. A power generation limit means restricts the amount of excitation at the time of a power generation voltage standup, suppresses power generation, thereby, mitigates the engine load under engine starting (henceforth the time of engine starting), and improves, the standup property, i.e., starting characteristic, of an engine speed. If it does in this way, the engine starting characteristic at the time of chill will be improved especially notably.
[0018] Furthermore, in this invention, the rate of rise of the power generation voltage after IG voltage impression is detected, when a standup is quick, it is at the engine rotation time, and it judges with it being possible to reduce the amount of power generation suppression (mitigation of an engine load), and the subsequent amount of suppression is reduced. On the other hand, when a standup is late, it is at the engine starting time, and it judges with it being necessary to make the engine starting characteristic good, and a reduction of the amount of suppression is not performed.
[0019] The following effects will be done so if it does in this way. First, since enhancement in an engine startability can be realized and the good amount of power generation can be secured at the time of engine rotation, the shortage of battery charge can be suppressed, a fall of the endurance of a battery can be suppressed, and a fall of battery terminal voltage can be suppressed. Moreover, since the amount of suppression is reduced and the standup of a power generation voltage becomes quick when cutoff of IG voltage and re-impression are performed to a regulator during rotation of a generator and it inspects the output state of a generator, check time can also be shortened.
[0020] In invention described in the claim 2, based on the power generation voltage after predetermined time progress, it

stands at the IG voltage impression time to a power generation voltage adjustment means, a top detects a speed, and invention described in the claim 3 detects the rate of rise based on the time of **** when a power generation voltage starts to a predetermined value. Such a detection formula is trustworthy and has the advantage which is easy to constitute a circuit. Usually, if IG voltage is impressed to a regulator during generator rotation (under engine rotation), a power generation voltage will be the time of about 150 or less msecs, and will start to a battery voltage grade. On the other hand, at the time of engine starting, the operating time (cranking time of an engine) of a starter is required, and the standup of a power generation voltage becomes late. Predetermined time is set to 100 - 200ms, if time until it starts a predetermined voltage value to 0.5-10V, then whether it starts to a predetermined voltage value by predetermined time for example, and a predetermined voltage value is less than predetermined time, it is alike in how and, therefore, the standup of a power generation voltage can be judged quickly and certainly.

[0021] In invention described in the claim 4, a predetermined voltage value is set up more highly than the power generation voltage at the time of the cranking of an engine. If it does in this way, when it drives by the starter and the engine is carrying out the cranking, with the power generation voltage by the residual magnetic induction of a generator, or the magnetic flux by the exciting current, it can judge with under engine rotation accidentally, and the situation of reducing the amount of power generation suppression can be avoided. Moreover, a predetermined voltage value is set up lower than the power generation voltage at the time of an idling of an engine. If it does in this way, it can judge with the time of engine starting at the time of engine rotation, and the situation where the amount of power generation suppression is not reduced can be avoided.

[0022] In invention described in the claim 5, power generation by the generator can be performed by the capacity. After IG voltage impression, invention described in the claim 6 turns on a charge warning lamp, when a power generation voltage becomes under a power generation detection threshold voltage. Furthermore, the above-mentioned power generation detection threshold voltage is set as a parvus value until a predetermined power generation detection time (it is generally the time when it is longer than 150msecs and the desirable time (generally 100msecs) when it is required for the standup of the power generation voltage under engine rotation) is completed from IG voltage impression, and after a power generation detection-time end sets the aforementioned power generation detection threshold voltage as a large value.

[0023] Like [in case IG voltage is impressed at the time of engine rotation], if it does in this way, when a power generation voltage starts for a short time after IG voltage impression, a power generation detection threshold voltage can detect the standup of a power generation voltage quickly by the parvus's, and can switch off quickly a charge warning lamp offensive to the eye. Furthermore, since a power generation voltage is lower than this high power generation detection threshold voltage when power generation is made not by the exciting current but by the residual magnetic induction (at for example, the time of a rotor-coil open circuit), since a power generation detection threshold voltage is made high, after a power generation voltage standup detection can detect it certainly and quickly, and can turn on and carry out the alarm of the charge warning lamp.

[0024] In addition, if the above-mentioned power generation detection time can be made equal to the predetermined time of invention described in the above-mentioned claim 2, it can make the predetermined voltage value of invention described in the above-mentioned claim 3 a power generation detection threshold voltage and it is carried out in this way, it can realize large simplification of circuit arrangement, and communalization. Moreover, if a switch means is made to adjust excitation like invention described in the claim 7, since power generation inhibitory control based on the rate of a conduction can be performed, formation of a control circuit becomes easy.

[0025]

[Example]

(Example 1) One example of this invention is hereafter explained with reference to drawing 1 . First, main components are explained. 1 is the output current control unit (regulator) of the generator for vehicles (three-phase-alternating-current generator which has the three-phase-full-wave-rectification machine 70 for power generation voltage commutation) of an engine (not shown) drive, and is intermittent with a switch 34 in the energizing voltage impressed to the rotor coil (exiting coil) 6 of a generator 2 so that output voltage (charge voltage to a battery 3) of the generator for vehicles 2 which charges the battery (battery) for vehicles 3 may be made into the predetermined voltage Vr. Electric power is supplied to the regulator 1 considering IG voltage which passed the ignition switch 4 as supply voltage, it intercepts a switch 34 at the time of opening of the ignition switch 4, and stops power generation of a generator 2. Moreover, although the ignition switch 4 has closed, when the power generation voltage of a generator 2 is below predetermined level or 0 (i.e., when rectification value (power generation voltage said by this invention) pinch-off-voltage' of 1 phase-voltage pinch off voltage of the stator coil 7 of a generator 2 is below the predetermined value Vrp in this example), Tr35 is made to conduct, and the charge warning lamp 5 is made to turn on.

[0026] 14 is a capacitor charged by throwing in the ignition switch 4. 15 is a comparator for intercepting predetermined time (the 1st setup time, about 150ms) after the ignition switch 4 is thrown in until the voltage of a capacitor 14 rises to a predetermined value, and the transistor (henceforth Tr) 16.

[0027] 19 is the 2nd capacitor charged by the current which flows resistance 20 by intercepting Tr21, when rectification value pinch-off-voltage' of 1 phase-voltage pinch off voltage of a stator coil exceeds a voltage Vrp. CR time constant for which it depends on the resistance of resistance 17 and 20 and the capacity of a capacitor 19 so that the charging time for about 10 seconds (the 2nd setup time) may be built over the charge voltage Vc of a capacitor 19 rising to the predetermined voltage Vr when Tr16 has conducted is set up. On the other hand, the above-mentioned time constant is set that the charging time for about 50ms (the 3rd setup time) is built over the charge voltage Vc rising to the predetermined voltage Vr when Tr16 is intercepting.

[0028] 22 is a comparator which compares rectification value (power generation voltage) pinch-off-voltage' with the predetermined voltage Vrp. A voltage Vrp is a threshold voltage given to the comparator 22 for a power generation detection, and is the voltage value which pressured supply voltage Vcc partially by resistance 51 and 52. A comparator 22 considers as a power generation detection, when power generation voltage pinch-off-voltage' exceeds a voltage Vrp, and it makes Tr 21 and 35 turn off. Diode 24, the capacitor 23, and the resistance 25 are rectifier circuits which rectify 1 phase-voltage pinch off voltage.
[0029] 29 is an oscillator circuit which outputs the rectangular-pulse signal of constant duty, and the proportion (ON duty ratio) of Hi level is set up to about 10%. The resistance which does not attach the sign in a drawing is base-current limit resistance of a transistor. Next, an operation of this regulator 1 is explained, explaining other components.
(at the time of engine starting) Since power generation of a generator 2 is stopped, the output of a comparator (it is also called a comparator) 22 serves as Hi, makes Tr35 conduct, and makes the charge lamp 5 turn on, if the ignition switch 4 is thrown in in the engine shutdown status.
[0030] Moreover, in order to also conduct Tr21, the charge voltage Vc serves as Lo, + input of a comparator 30 becomes lower than the - input Vr, i.e., a predetermined voltage, and a comparator 30 outputs Lo to OR circuit 31. Thereby, the output of OR circuit 31 becomes equal to the pulse shape outputted from an oscillator circuit 29. When [this] the generator 2 has not generated electricity, 28 is a comparator which compares partial pressure Va and the predetermined voltage Vr of battery voltage, a comparator 28 outputs Hi to AND circuit 32, AND circuit 32 impresses the above-mentioned pulse shape outputted from an oscillator circuit 29 to the base of Tr(switch) 34, and Tr34 is conducted synchronizing with the above-mentioned pulse shape, and impresses energizing voltage to a rotor coil 6 intermittently. That is, if the ignition switch 4 is thrown in in the engine shutdown status, energizing voltage will be impressed to a rotor coil 6 at the rate of a conduction which synchronizes with the above-mentioned pulse shape.
[0031] Next, after an injection of the ignition switch 4, it goes up in time for about 1ms, the voltage of the node of resistance 43 and the reference diode 12 serves as fixed level according to it, Tr11 conducts the supply voltage Vcc of this regulator 1, and a capacitor 14 is charged through resistance 13. A comparator 15 compares with charge voltage Vc' of a comparator 14 the partial pressure of the supply voltage Vcc which the partial pressure circuit which consists of resistance 41 and 42 outputs, and if charge voltage Vc' is set to Hi, it makes Tr16 turn on. Here, after an injection of the ignition switch 4, the output of a comparator 15 is reversed to Hi in about 150ms, and the capacity of the resistance 41, 42, and 13 and the capacitor 14 is set up so that Tr16 may be conducted.
[0032] Furthermore, the meaning which Tr16 is delayed for about 150ms, and turns on from an injection of the ignition switch 4 is explained below. That is, since the cranking time of the engine by the starter though an engine is started simultaneously with an injection of the ignition switch 4 at the time of engine starting is generally 200ms or more, Tr16 is continuity, before it detects power generation of a generator 2 and the output of a comparator 22 serves as Lo.
[0033] Therefore, since Tr16 turns on before a transistor 21 turns off, if power generation voltage pinch-off-voltage' exceeds a voltage Vrp and carries out a power generation detection by the comparator 22 at the time of engine starting, about 10s is needed after [of a transistor 21] off a capacitor 19 being charged only by resistance 20 and charging to a reference voltage Vr. In this charging time, it is set to Lo and the above-mentioned pulse shape is impressed to Tr34, it becomes the mean energizing voltage of a rotor coil 6 is the same with ON duty ratio of the above-mentioned pulse shape, and fixed [energizing voltage] 10%, power generation of a generator 2 is suppressed, and, as for the output of a comparator 30, too much torque is not applied to the engine immediately after starting.
[0034] On the other hand, after an injection of the ignition switch 4, if 10s or more passes, the charge voltage Vc of a capacitor 19 will become more than predetermined voltage Vr by resistance 20, the output of a comparator 30 will take Hi, and a rotor coil 6 will be controlled by output voltage of a comparator 28. That is, a comparator 28 compares the predetermined voltage Vr with the partial pressure Va of battery voltage, and it is controlled so that a switch 34 is opened and closed by the comparison output and the partial pressure Va of battery voltage turns into the predetermined voltage Vr by it.
[0035] In addition, the predetermined voltage Vr is partial pressure of target battery voltage, and is partial pressure of supply voltage Vcc. If resistance 43 is disregarded, supply voltage Vcc is the output voltage of the voltage stabilizer which consists of a series-connection circuit of resistance 10, the voltage between base emitters of a transistor 11, and the reference diode 12, is not concerned with change of IG voltage, but is stabilized.
(Outgoing inspection) Next, the outgoing-inspection work at the time of product shipment of a generator 2 is explained.
[0036] If the ignition switch 4 is thrown in where the rotational frequency of a generator 2 is made into a nominal speed (5000rpm), the energizing voltage which synchronized with the pulse shape from an oscillator circuit 29 will be impressed to a rotor coil 6 like the time of engine starting which gave [above-mentioned] explanation. Generally, if there is time about [of a rotor coil 6] a time constant (phase lag of a **** current, about 150ms), 1 phase-voltage pinch off voltage of a generator 2 will become more than the voltage of a battery 3. Power generation is detectable after an injection of the ignition switch 4 by choosing suitably the predetermined value (power generation detection threshold) Vrp within 100ms.
[0037] In addition, at this power generation detection time, by hardly charging, since charge voltage Vc' is below Vr, a capacitor 14 Tr16 is intercepting and the charging time of a capacitor 19 is set to 50ms by addition of the charging current from resistance 17. Consequently, the output of a comparator 30 serves as Hi after an injection of the ignition switch 4 within 150ms. Excitation becomes possible with 100% of ON duty ratio about a rotor coil 6 (when the partial pressure Va of battery voltage is lower than the predetermined voltage Vr), and a check of the maximum output of a generator 2 is attained for a short time.

[0038] (at the time of engine rotation) Next, the operation at the time of engine rotation is explained. When switching on again during rotation of an engine and the generator 2, using the ignition switch 4 as ******, Or when IG voltage impressed to a regulator 1 by a certain cause falls sharply temporarily and a regulator 1 judges subsequent IG power surge to be an injection of the ignition switch 4 (when performing the operation as the time of an injection of the ignition switch 4 with the same regulator 1), Since it is an injection of the ignition switch 4 under rotation of an engine and the generator 2, the same control action as the time of the outgoing inspection substantially described above is performed.
[0039] That is, the output of a comparator 30 serves as Hi after an injection of the ignition switch 4 within 150ms, and the rate limit of a conduction of a switch 34 can be canceled at an early stage.
(Example 2) The 2nd example is explained with reference to drawing 2 which shows the important section of a regulator 1. Drawing 3 is the timing chart of the regulator 1 of drawing 2 .
[0040] The focus of this example is listed. This example makes the capacitor integration formula of an example 1 a counter formula. That is, in this example, the capacitor 19 which defines the rate time limit of a conduction of the power generation detection point in time by the comparator 22 to the excitation (cancel of the rate limit of conduction) time of the rotor coil 6 in 100% (at the time of a battery voltage fall) is changed into the n step binary counter 108.
[0041] Moreover, the capacitor 14 which sets the predetermined time (the 1st hour) from IG voltage impression in an example 1 is changed into the hold circuit 104 set by the trigger pulse TGP generated at the time of IG voltage impression. A hold circuit 104 is reset by the trigger pulse CK2 generated after time delay (150msec) progress predetermined [after IG voltage impression].
[0042] Furthermore, after predetermined one carries out [aforementioned] time delay (1st hour) progress from IG voltage impression time, power generation detection threshold is changed into big predetermined value Vrph from the predetermined value Vrp by setting the output of NOT circuit 105 to Hi. in addition -- predetermined -- a value -- Vrp -- a switch -- 34 -- intercepting -- **** -- a case -- a rotor coil -- six -- a residual magnetic induction -- generating -- a stator -- seven -- one -- phase voltage -- pinch off voltage -- a rectification -- a value -- pinch off voltage -- ' -- small -- setting up -- having -- **** -- predetermined -- a value -- Vrph -- the above -- a residual magnetic induction -- generating -- a stator -- seven -- one -- phase voltage -- pinch off voltage -- a rectification -- a value -- pinch off voltage -- ' -- being big --
[0043] Supply voltage Vcc will be determined by the voltage stabilizer by reference diode 101, the voltage between base emitters of a transistor 102, and the resistance 10 if resistance 120 is disregarded. A capacitor 100 is for carrying out supply voltage Vcc few time-delay totals, and forming the initial trigger pulse TGP of a counter 108 or the hold circuit 104 from IG voltage.
[0044] Hereafter, other configurations and operations are explained.
(at the time of IG voltage impression) If IG voltage is impressed to the ignition switch terminal of a regulator 1 Only a short time (refer to drawing 3) until Tr102 conducts by the retardation by the above-mentioned capacitor 100 etc. is charged by resistance 121, and a joint CKO serves as Hi. The initial trigger pulse TGP is inputted into set terminal S of a hold circuit 104, and the Q output is set to Hi, and it is inputted into the reset terminal R2 of a counter 108, and the counted value of a counter 108 is 2n. It is reset by the value. If Q output of a hold circuit 104 serves as Hi, the output of NOT circuit 105 will serve as Lo, the voltage of line L will serve as the low predetermined value Vrp (here 2 V), and the power generation detection threshold voltage of a comparator 22 will serve as this low Vrp.
[0045] Moreover, although the pulse CK2 from the clock circuit 110 is periodically inputted into reset terminal R of a hold circuit 104, as shown in drawing 3 , let this pulse CK2 be a long period (150msec). Therefore, AND circuit 107 outputs Lo and a reset signal Hi is not inputted into the reset terminal R1 of a counter 108 after IG voltage inputs until predetermined time (1st hour) 150msec passes.
[0046] The engine is rotating. (when the rate of rise of a power generation voltage is quick at the time of engine rotation) If rectification value pinch-off-voltage' starts within the predetermined time after IG voltage impression (term when 150ms104, i.e., a hold circuit, is set here) The output of a comparator 22 serves as Lo, while the charge warning lamp 5 is switched off, the output of NOT circuit 113 serves as Hi, and a counter 108 raises a count from the counted value of 2n to the timing of the pulse CK1 outputted from the clock generation circuit 111. Naturally at this time, the output of NOT circuit 109 serves as Hi.
[0047] The counted value of a counter 108 carries out a count rise by the pulse CK1 of the clock generation circuit 111, and it is 20. When it becomes, Q output of a counter 108 serves as Hi, the output of NOT circuit 109 serves as Lo, a count rise is stopped, using the output of AND circuit 112 as Lo, and counted value is 20. It becomes keeping. Simultaneously, the output of OR circuit 31 serves as Hi, and enables excitation of a rotor coil 6 with 100% of ON duty ratio. Furthermore, the output of NOT circuit 106 serves as Lo, and even if 150msecs pass by this and a pulse CK2 inputs into AND circuit 107, Hi is made not to be inputted into the reset terminal R1.
[0048] That is, the rapid standup of rectification value pinch-off-voltage' is detected in this case, the rate limit of a conduction of a switch 34 is canceled after 150msecs, and quick battery powerful charge is realized. In addition, as shown in drawing 3 , the pulse CK2 from the clock circuit 110 inputs into reset terminal R of a hold circuit 104, Q output of a hold circuit 104 serves as Lo, NOT circuit 105 outputs Hi, the voltage of line L serves as high predetermined value Vrph (here 10 V), and the voltage detection threshold (+ input edge voltage) of a comparator 22 is set up highly 150ms after IG voltage impression.
[0049] In rotation of an engine, if it does in this way, while the standup of a power generation voltage is quickly detectable immediately after IG voltage impression (after 150msec) with few [a power generation voltage] standups, since a threshold voltage increases, even if the power generation voltage has arisen by the residual magnetization by the open circuit of a rotor coil 6 etc., a comparator 22 outputs a power generation halt (Hi), and can turn on the charge lamp 5 certainly.

(when the rate of rise of a power generation voltage is slow at the time of engine starting) The case where a detection (that is, that a comparator 22 is set to Lo) of the standup of power generation becomes after IG voltage impression and 150ms or more progress is explained.

[0050] Since the pulse CK2 from the clock circuit 110 is inputted into AND circuit 107 as shown in drawing 3 , and NOT circuit 106 and the hold circuit 104 are outputting Hi 150ms after IG voltage impression at this time, without a comparator 22 detecting the standup of rectification value pinch-off-voltage', the counted value of a counter 108 is 21. It is reset.

[0051] Moreover, a pulse CK2 is inputted into reset terminal R of a hold circuit 104, and resets Q output of a hold circuit 104 to Lo. Thereby, NOT circuit 105 is set to Hi and the threshold of a comparator 22 increases to predetermined value Vrph. Then, if rectification value (power generation voltage) pinch-off-voltage' goes up by engine starting and it becomes more than predetermined value Vrph A comparator 22 serves as Lo (detecting power generation), and a counter 108 carries out a count rise to the timing of a pulse CK1. 21 A long count rise of a time is performed from a value (2n-1), and it is 20. It becomes a value and is 20. After becoming, AND circuit 112 outputs Lo, a count rise of a counter 108 is completed and Hi voltage is outputted to OR circuit 31 and NOT circuit 106. In addition, S priority FF is used for 104 here, and the one-shot multivibrator is used for 110.

[0052] Therefore, the rate of a conduction of a switch 34 can be restricted with ON duty ratio of an oscillator circuit 29 until the time when it is twice (2n-1) many as the period (T1) of a pulse CK1 passes in this case. Therefore, the charge warning lamp 5 is turned on until a comparator 22 detects power generation in this case.

[0053] Hereafter, a lighting control of the charge warning lamp 5 at the time of engine rotation is explained further. When the output of a hold circuit 104 is set to Hi in predetermined time (150ms) from the time of IG voltage impression The output of NOT circuit 105 serves as Lo, and NOT circuit 105 absorbs a current from line L through resistance 123, and makes the voltage of line L the low predetermined value Vrp. By this the power generation detection threshold of a comparator 22 by making it the low predetermined value Vrp When IG voltage is impressed during rotation of a generator 2, the charge warning lamp 5 is made not to turn on only slight time (less than 100ms) until power generation of a generator 2 starts to this low predetermined value Vrp.

[0054] On the other hand, after a power generation standup (less than 100ms), since the threshold voltage of a comparator 22 serves as high predetermined value Vrph, supposing it has generated electricity not by the exciting current but by the residual magnetization, power generation voltage pinch-off-voltage' is small, and since a comparator 22 serves as Hi, after the 1st-hour (150ms) progress which becomes settled by the clock circuit 110 can detect it, and can turn on the charge warning lamp 5.

[0055] In addition, although constituted from a hardware electronic circuitry, it can also constitute from an above-mentioned example using other hardware electronic circuitries and microcomputer circuits which have the same function. 28 constitutes the important section of a power-generation voltage-adjustment means, incidentally 29 constitutes the important section of the rate limit means of a conduction in an example 1, and 22 is a part of rate limit suppression means of a conduction, the fraction which detects whether the standup of the power-generation voltage after IG voltage impression is quick, and 21 are a part of rate limit suppression meanses of a conduction, and when a standup is quick, they are the fraction which suppresses the rate limit of a conduction by the rate limit means of a conduction.

[0056] Moreover, in an example 2, 22 constitutes the important section of a power generation detection means, and the hold circuit 104 and NOT circuit 105 constitute the important section of a threshold change means.

[Translation done.]

EFFECT OF THE INVENTION

[An operation and an effect of the invention] A power generation voltage adjustment means performs excitation based on battery voltage after impression of IG voltage. A power generation limit means restricts the amount of excitation at the time of a power generation voltage standup, suppresses power generation, thereby, mitigates the engine load under engine starting (henceforth the time of engine starting), and improves, the standup property, i.e., starting characteristic, of an engine speed. If it does in this way, the engine starting characteristic at the time of chill will be improved especially notably.

[0018] Furthermore, in this invention, the rate of rise of the power generation voltage after IG voltage impression is detected, when a standup is quick, it is at the engine rotation time, and it judges with it being possible to reduce the amount of power generation suppression (mitigation of an engine load), and the subsequent amount of suppression is reduced. On the other hand, when a standup is late, it is at the engine starting time, and it judges with it being necessary to make the engine starting characteristic good, and a reduction of the amount of suppression is not performed.

[0019] The following effects will be done so if it does in this way. First, since enhancement in an engine startability can be realized and the good amount of power generation can be secured at the time of engine rotation, the shortage of battery charge can be suppressed, a fall of the endurance of a battery can be suppressed, and a fall of battery terminal voltage can be suppressed. Moreover, since the amount of suppression is reduced and the standup of a power generation voltage becomes quick when cutoff of IG voltage and re-impression are performed to a regulator during rotation of a generator and it inspects the output state of a generator, check time can also be shortened.

[0020] In invention described in the claim 2, based on the power generation voltage after predetermined time progress, it stands at the IG voltage impression time to a power generation voltage adjustment means, a top detects a speed, and invention described in the claim 3 detects the rate of rise based on the time of **** when a power generation voltage starts to a predetermined value. Such a detection formula is trustworthy and has the advantage which is easy to constitute a circuit. Usually, if IG voltage is impressed to a regulator during generator rotation (under engine rotation), a power generation voltage will be the time of about 150 or less msecs, and will start to a battery voltage grade. On the other hand, at the time of engine starting, the operating time (cranking time of an engine) of a starter is required, and the standup of a power generation voltage becomes late. Predetermined time is set to 100 - 200ms, if time until it starts a predetermined voltage value to 0.5-10V, then whether it starts to a predetermined voltage value by predetermined time for example, and a predetermined voltage value is less than predetermined time, it is alike in how and, therefore, the standup of a power generation voltage can be judged quickly and certainly.

[0021] In invention described in the claim 4, a predetermined voltage value is set up more highly than the power generation voltage at the time of the cranking of an engine. If it does in this way, when it drives by the starter and the engine is carrying out the cranking, with the power generation voltage by the residual magnetic induction of a generator, or the magnetic flux by the exciting current, it can judge with under engine rotation accidentally, and the situation of reducing the amount of power generation suppression can be avoided. Moreover, a predetermined voltage value is set up lower than the power generation voltage at the time of an idling of an engine. If it does in this way, it can judge with the time of engine starting at the time of engine rotation, and the situation where the amount of power generation suppression is not reduced can be avoided.

[0022] In invention described in the claim 5, power generation by the generator can be performed by the capacity. After IG voltage impression, invention described in the claim 6 turns on a charge warning lamp, when a power generation voltage becomes under a power generation detection threshold voltage. Furthermore, the above-mentioned power generation detection threshold voltage is set as a parvus value until a predetermined power generation detection time (it is generally the time when it is longer than 150msecs and the desirable time (generally 100msecs) when it is required for the standup of the power generation voltage under engine rotation) is completed from IG voltage impression, and after a power generation detection-time end sets the aforementioned power generation detection threshold voltage as a large value.

[0023] Like [in case IG voltage is impressed at the time of engine rotation], if it does in this way, when a power generation voltage starts for a short time after IG voltage impression, a power generation detection threshold voltage can detect the standup of a power generation voltage quickly by the parvus's, and can switch off quickly a charge warning lamp offensive to the eye. Furthermore, since a power generation voltage is lower than this high power generation detection threshold voltage when power generation is made not by the exciting current but by the residual magnetic induction (at for example, the time of a rotor-coil open circuit), since a power generation detection threshold voltage is made high, after a power generation voltage standup detection can detect it certainly and quickly, and can turn on and carry out the alarm of the charge warning lamp.

[0024] In addition, if the above-mentioned power generation detection time can be made equal to the predetermined time of

invention described in the above-mentioned claim 2, it can make the predetermined voltage value of invention described in the above-mentioned claim 3 a power generation detection threshold voltage and it is carried out in this way, it can realize large simplification of circuit arrangement, and communalization. Moreover, if a switch means is made to adjust excitation like invention described in the claim 7, since power generation inhibitory control based on the rate of a conduction can be performed, formation of a control circuit becomes easy.

[Translation done.]

MEANS

[The means for solving a technical problem] From the battery charged with the generator for vehicles driven with an engine, while IG voltage is impressed as supply voltage through an ignition switch, invention described in the claim 1 A power generation voltage adjustment means to adjust the excitation status of the aforementioned generator for vehicles based on the thermodynamic function about the terminal voltage of the aforementioned battery, In the output current control unit of the generator for vehicles equipped with a power generation limit means to restrict the amount of excitation of the aforementioned generator for vehicles at the time of the power generation voltage standup of the aforementioned generator for vehicles, and to suppress power generation It is characterized by having an amount adjustment means of suppression to detect the speed at which the aforementioned power generation voltage starts, and to change the amount of suppression of the aforementioned power generation according to the detected rate of rise after IG voltage impressing [aforementioned] to the aforementioned power generation voltage adjustment means.
[0009] In what described invention described in the claim 2 in the claim 1, the aforementioned amount adjustment means of suppression is characterized by detecting the aforementioned rate of rise from the aforementioned IG voltage impression point in time based on the aforementioned power generation voltage after predetermined time progress. It is characterized by invention described in the claim 3 detecting the rate of rise based on time until it sets to what was described in the claim 1 and it reaches a value predetermined [means / amount adjustment / aforementioned / of suppression] in IG voltage impression point in time to a power generation voltage.
[0010] Invention described in the claim 4 has the aforementioned predetermined value higher than the power generation voltage at the time of a cranking in what was described in the claim 1, and it is characterized by being set up lower than the power generation voltage at the time of an idle. In what described invention described in the claim 5 in the claim 1, the aforementioned amount adjustment means of suppression is characterized by canceling a limit of power generation by the power generation limit means.
[0011] A power generation detection means to turn on a charge warning lamp in what described invention described in the claim 6 in the claim 1 when the aforementioned power generation voltage becomes under a power generation detection threshold voltage after IG voltage impression, The aforementioned power generation detection threshold voltage is set as a parvus value until predetermined carries out power generation detection-time progress from IG voltage impression, and after the aforementioned power generation detection-time progress is characterized by having a threshold change means to set the aforementioned power generation detection threshold voltage as a large value.
[0012] Invention described in the claim 7 is characterized by corresponding to the rate of a conduction of a switch means by which the excitation status of a generator is intermittent in the exciting current of a generator in what was described in the claim 1. Hereafter, the vocabulary relevant to this invention is explained. The terminal voltage of a battery is sufficient as the thermodynamic function (only henceforth battery voltage) about the terminal voltage of a battery, and the thermodynamic function interlocked with it is sufficient as it.
[0013] The rectification voltage besides the output terminal voltage of a generator is sufficient as a power generation voltage, or the terminal voltage of the battery with which this rectification voltage is impressed is sufficient as it. In what is intermittent in an exciting current with a switch means, suppression of power generation means restricting the rate of a conduction to a parvus value rather than the rate of a conduction outputted to a switch, in order to obtain the amount of power generation to which it is less than at least 100% of a value, and a power generation voltage adjustment means should make the rate of a conduction of a switch means output based on the thermodynamic function about battery terminal voltage.
[0014] When a detection of the rate of rise of a power generation voltage impresses IG voltage to a regulator, time until a power generation voltage reaches a predetermined value from the time (the time of impressing IG voltage to a regulator is sufficient) of having a fixed relation can distinguish by the comparator etc. whether it is below predetermined time, and also the augend within the predetermined time of a power generation voltage may distinguish with a comparator etc. whether it is beyond a predetermined value. Furthermore, since it depends greatly at the cranking time of a starter, the rate of rise of a power generation voltage can also detect the rate of rise of a power generation voltage by distinguishing whether the parameter relevant to the cranking time of a starter exceeds predetermined level. For example, since battery voltage or IG voltage falls, it can distinguish whether the rate of rise of a power generation voltage is quick or late by time until battery voltage or IG voltage becomes below predetermined level and exceeds predetermined level after that, namely, the inside of the cranking of a starter can distinguish the time of engine starting and engine rotation.
[0015] At the time of the cranking of an engine, the time of the status which the engine is driving by the starter is said. It is

defined as adjustment of the amount of suppression as a thing including both of halt of relief of the amount of suppression, and suppression. Moreover, the amount of suppression may be suppression time. In one mode, if the rate of rise of a power generation voltage is comparatively slow, the amount of suppression will be reduced, and as long as it is comparatively quick, you may increase the amount of suppression.

[0016] IG voltage says the voltage impressed to the output current control unit of the generator for vehicles from a battery through an ignition switch. Impression of IG voltage includes the case where it becomes more than predetermined level again, after IG voltage falls below to predetermined level.

[Translation done.]

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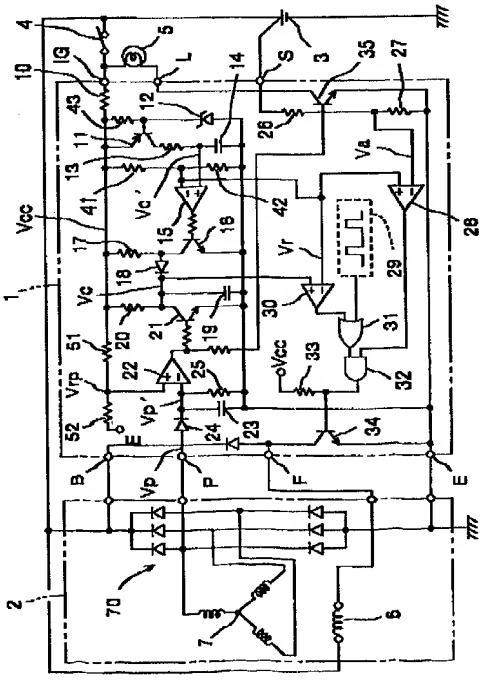
(54)【発明の名称】　車両用発電機の出力電流制御装置

(57)【要約】
エンジン始動時には導通率制限を実施するとともに、エンジン回転時に導通率制限を抑制してバッテリ充電電流の不足を抑止可能な車両用発電機の出力電流制御装置を提供する。
【構成】発電電圧調整手段２８は、ＩＧ電圧の印加後、バッテリ電圧に基づいてスイッチ３４を開閉して励磁電流を断続させる。導通率制限手段２９は、発電電圧立ち上がり時にスイッチ３４の導通率を制限して発電を抑制する。導通率制限抑制手段１５は、ＩＧ電圧印加後の発電電圧の立ち上がり速度を検出し、立ち上がりが速い場合には、導通率制限を抑制することが可能と判定し、その後の導通率制限を抑制し、立ち上がりが遅い場合には、エンジン始動時であって導通率制限の抑制は行わない。



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【特許請求の範囲】

【請求項１】エンジンにより駆動される車両用発電機によって充電されるバッテリから、イグニッションスイッチを通じてＩＧ電圧が電源電圧として印加されるとともに、前記バッテリの端子電圧に関する状態量に基づいて前記車両用発電機の励磁状態を調整する発電電圧調整手段と、前記車両用発電機の発電電圧立ち上がり時に前記車両用発電機の励磁量を制限して発電を抑制する発電制限手段とを備える車両用発電機の出力電流制御装置において、

前記発電電圧調整手段への前記ＩＧ電圧印加後に前記発電電圧が立ち上がる速度を検出し、検出された立ち上がり速度に応じて前記発電の抑制量を変化させる抑制量調整手段を備えることを特徴とする車両用発電機の出力電流制御装置。

【請求項２】前記抑制量調整手段は、前記ＩＧ電圧印加時点から所定の時間経過後の前記発電電圧に基づいて前記立ち上がり速度を検出するものである請求項１記載の車両用発電機の出力電流制御装置。

【請求項３】前記抑制量調整手段は、ＩＧ電圧印加時点から発電電圧が所定の値に達するまでの時間に基づいて立ち上がり速度を検出するものである請求項１記載の車両用発電機の出力電流制御装置。

【請求項４】前記所定の値は、クランキング時の発電電圧より高く、アイドル時の発電電圧より低く設定される請求項１記載の車両用発電機の出力電流制御装置。

【請求項５】前記抑制量調整手段は、発電制限手段による発電の制限を解除するものである請求項１記載の車両用発電機の出力電流制御装置。

【請求項６】ＩＧ電圧印加後、前記発電電圧が発電検出しきい値電圧未満となる場合にチャージウオーニングランプを点灯する発電検出手段と、ＩＧ電圧印加から所定の発電検出時間経過するまでは前記発電検出しきい値電圧を小さい値に設定し、前記発電検出時間経過後は前記発電検出しきい値電圧を大きい値に設定するしきい値変更手段とを備える請求項１記載の車両用発電機の出力電流制御装置。

【請求項７】発電機の励磁状態は発電機の励磁電流を断続するスイッチ手段の導通率に対応するものである請求項１記載の車両用発電機の出力電流制御装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は車両用発電機の出力電流制御装置に関する。

【０００２】

【従来の技術】特開平３－１７３３２４号公報は、車両用発電機の出力電流制御装置（レギュレータともいう）において、ＩＧ電圧の印加後、発電電圧が所定レベルまで上昇したことを検出すれば（すなわち発電を検出すれば）、励磁電流制御スイッチの導通率を所定時間制限して発電を抑制し、その後、導通率を必要値まで漸増することを開示している。

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【０００３】

【発明が解決しようとする課題】しかしながら、上記した従来の方式は、エンジン状態にかかわらず上記導通率制限を発電検出後、所定の時間実施するので、導通率制限が不要となっている状況にもかかわらず導通率制限を持続し、バッテリ容量が低下するという不具合があった。

【０００４】例えば、車両走行中においてエンジン負荷の軽減により車両の加速性向上を図る場合など、エンジン回転中又は車両走行中にレギュレータへのＩＧ電圧を必要な短期間だけ遮断し、その後、レギュレータにＩＧ電圧を再印加する場合がある。また、発電電圧のリップルなどによりＩＧ電圧が一時的に低下する場合もある。そして、このような場合、上記した従来方式では、ＩＧ電圧が一度低下してその後、発電電圧が上昇するのでその後、所定時間だけ上記導通率制限（発電抑制）がなされ、バッテリ容量が低下するという不具合があった。

【０００５】また、これらの発電電圧の一時的な低下時にチャージウオーニングランプが長く点灯して煩わしいという不具合があった。また、発電機の回転中にレギュレータにＩＧ電圧の印加を行って発電機の出力状態を検査する場合、上記した導通率制限すなわち発電抑制が働くと検査時間が長くなるという不具合もあった。

【０００６】本発明は上記問題点に鑑みなされたものであり、エンジン始動時には導通率制限を実施するとともに、エンジン回転時に導通率制限を抑制してバッテリ充電電流の不足を抑止可能な車両用発電機の出力電流制御装置を提供することを、その第一の目的としている。また、エンジン回転中における一時的な発電電圧の落ち込みの後の再上昇時に上記した導通率制限が作動してバッテリ充電電流が不足するのを防止可能な車両用発電機の出力電流制御装置を提供することを、その第二の目的としている。

【０００７】また、エンジン回転中における一時的な発電電圧の低下時のチャージウオーニングランプの点灯を短縮可能な車両用発電機の出力電流制御装置を提供することを、その第三の目的としている。更に、発電機の回転中における発電状態の検査時における導通率制限による検査時間の延長を回避可能な車両用発電機の出力電流制御装置を提供することを、その第四の目的としている。

【０００８】

【課題を解決するための手段】請求項１に記した発明は、エンジンにより駆動される車両用発電機によって充電されるバッテリから、イグニッションスイッチを通じてＩＧ電圧が電源電圧として印加されるとともに、前記バッテリの端子電圧に関する状態量に基づいて前記車両用発電機の励磁状態を調整する発電電圧調整手段と、前

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記車両用発電機の発電電圧立ち上がり時に前記車両用発電機の励磁量を制限して発電を抑制する発電制限手段とを備える車両用発電機の出力電流制御装置において、前記発電電圧調整手段への前記ＩＧ電圧印加後に前記発電電圧が立ち上がる速度を検出し、検出された立ち上がり速度に応じて前記発電の抑制量を変化させる抑制量調整手段を備えることを特徴としている。

【０００９】請求項２に記した発明は請求項１に記したものにおいて、前記抑制量調整手段が、前記ＩＧ電圧印加時点から所定の時間経過後の前記発電電圧に基づいて前記立ち上がり速度を検出することを特徴としている。請求項３に記した発明は請求項１に記したものにおいて、前記抑制量調整手段が、ＩＧ電圧印加時点から発電電圧が所定の値に達するまでの時間に基づいて立ち上がり速度を検出することを特徴としている。

【００１０】請求項４に記した発明は請求項１に記したものにおいて、前記所定の値が、クランキング時の発電電圧より高く、アイドル時の発電電圧より低く設定されることを特徴としている。請求項５に記した発明は請求項１に記したものにおいて、前記抑制量調整手段が、発電制限手段による発電の制限を解除することを特徴としている。

【００１１】請求項６に記した発明は請求項１に記したものにおいて、ＩＧ電圧印加後、前記発電電圧が発電検出しきい値電圧未満となる場合にチャージウオーニングランプを点灯する発電検出手段と、ＩＧ電圧印加から所定の発電検出時間経過するまでは前記発電検出しきい値電圧を小さい値に設定し、前記発電検出時間経過後は前記発電検出しきい値電圧を大きい値に設定するしきい値変更手段とを備えることを特徴としている。

【００１２】請求項７に記した発明は請求項１に記したものにおいて、発電機の励磁状態が発電機の励磁電流を断続するスイッチ手段の導通率に対応することを特徴としている。以下、本発明に関連する用語を説明する。バッテリの端子電圧に関する状態量（以下、単にバッテリ電圧ともいう）は、バッテリの端子電圧でもよく、また、それと連動する状態量でもよい。

【００１３】発電電圧は発電機の出力端子電圧の他、その整流電圧でもよく、又はこの整流電圧が印加されるバッテリの端子電圧でもよい。スイッチ手段により励磁電流を断続するものにおいて、発電の抑制とは、スイッチ手段の導通率を少なくとも１００％未満の値であって、発電電圧調整手段がバッテリ端子電圧に関する状態量に基づいて出力させるべき発電量を得るためにスイッチへ出力する導通率よりも小さい値に導通率を制限することを意味する。

【００１４】発電電圧の立ち上がり速度の検出は、ＩＧ電圧をレギュレータに印加する時点に一定の関係を有する時点（ＩＧ電圧をレギュレータに印加する時点でもよい）から発電電圧が所定値に達するまでの時間が所定時

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間以下かどうかを比較器などで判別することができる他、発電電圧の所定時間内における増加量が所定値以上かどうかをコンパレータなどで判別してもよい。更に、発電電圧の立ち上がり速度は、スタータのクランキング時間に大きく依存するので、スタータのクランキング時間に関連するパラメータが所定レベルを超えるか否かを判別することにより発電電圧の立ち上がり速度を検出することもできる。例えば、バッテリ電圧又はＩＧ電圧はスタータのクランキング中は低下するので、バッテリ電圧又はＩＧ電圧が所定レベル以下となり、その後所定レベルを超えるまでの時間により発電電圧の立ち上がり速度が速いか遅いかを判別することができ、すなわち、エンジン始動時かエンジン回転時かを判別することができる。

【００１５】エンジンのクランキング時は、エンジンがスタータにより駆動されている状態時をいう。抑制量の調整には、抑制量の緩和、抑制の停止の両方を含めるものとして定義している。また、抑制量とは抑制時間であってもよい。一態様において、例えば発電電圧の立ち上がり速度が比較的遅ければ抑制量を減らし、比較的速ければ抑制量を増加してもよい。

【００１６】ＩＧ電圧は、イグニッションスイッチを通じてバッテリから車両用発電機の出力電流制御装置に印加される電圧をいう。ＩＧ電圧の印加は、ＩＧ電圧が所定レベル以下に低下した後、再度所定レベル以上になった場合を含む。

【００１７】

【作用及び発明の効果】発電電圧調整手段は、ＩＧ電圧の印加後、バッテリ電圧に基づいた励磁を実行する。発電制限手段は、発電電圧立ち上がり時に励磁量を制限して発電を抑制し、これにより、エンジン始動中（以下、エンジン始動時ともいう）のエンジン負荷を軽減し、エンジン回転数の立ち上がり特性すなわち始動特性を改善する。このようにすれば、特に寒冷時のエンジン始動特性が顕著に改善される。

【００１８】更に本発明では、ＩＧ電圧印加後の発電電圧の立ち上がり速度を検出し、立ち上がりが速い場合には、エンジン回転時であって発電抑制（エンジン負荷の軽減）の量を低減することが可能と判定し、その後の抑制量を低減する。一方、立ち上がりが遅い場合には、エンジン始動時であってエンジン始動特性を良好にする必要があると判定し、抑制量の低減は行わない。

【００１９】このようにすれば、以下の効果を奏する。まず、エンジン始動性向上を実現でき、かつ、エンジン回転時には良好な発電量を確保することができるためバッテリ充電不足を抑制することができ、バッテリの耐久性の低下を抑制し、バッテリ端子電圧の低下を抑制することができる。また、発電機の回転中にレギュレータにＩＧ電圧の遮断、再印加を行って発電機の出力状態を検査する場合、抑制量が低減されて発電電圧の立ち上がり

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が速くなるので検査時間を短縮することもできる。

【００２０】請求項２に記した発明では、発電電圧調整手段へのＩＧ電圧印加時点から所定の時間経過後の発電電圧に基づいて立ち上が速度を検出するものであり、また請求項３に記した発明は、発電電圧が所定の値に立ち上がるまての時間に基づいて立ち上がり速度を検出するものである。このような検出方式は確実であり、回路を構成し易い利点がある。通常、発電機回転中（エンジン回転中）にレギュレータにＩＧ電圧が印加されると、発電電圧は約１５０ｍｓｅｃ以下の時間で、バッテリ電圧程度まで立ち上がる。一方、エンジン始動時にはスタータの動作時間（エンジンのクランキング時間）が必要であり、発電電圧の立ち上がりは遅くなる。したがって、所定時間を１００～２００ｍｓとし、所定の電圧値を０．５～１０Ｖとすれば、例えば、所定時間までに所定の電圧値に立ち上がるかどうか、または、所定の電圧値に立ち上がるまでの時間が所定時間以内であるとどうか、によって発電電圧の立ち上がりを素早くかつ確実に判定できる。

【００２１】請求項４に記した発明では、所定の電圧値は、エンジンのクランキング時の発電電圧より高く設定される。このようにすれば、スタータにより駆動されてエンジンがクランキングしている場合に、発電機の残留磁束又は励磁電流による磁束による発電電圧により、誤ってエンジン回転中と判定して発電抑制量を低減してしまうという事態を回避することができる。また、所定の電圧値は、エンジンのアイドリング時の発電電圧より低く設定される。このようにすれば、エンジン回転時にエンジン始動時と判定して発電抑制量を低減しないという事態を回避することができる。

【００２２】請求項５に記した発明では、発電機による発電をその能力分だけ実行させることができる。請求項６に記した発明は、ＩＧ電圧印加後、発電電圧が発電検出しきい値電圧未満となる場合にチャージウオーニングランプを点灯する。更に、ＩＧ電圧印加から所定の発電検出時間（一般に１５０ｍｓｅｃ，好ましくはエンジン回転中の発電電圧の立ち上がりに必要な時間（一般に１００ｍｓｅｃ）よりは長い時間）が終了するまでは上記発電検出しきい値電圧を小さい値に設定し、発電検出時間終了後は前記発電検出しきい値電圧を大きい値に設定する。

【００２３】このようにすれば、エンジン回転時にＩＧ電圧が印加される場合のように、ＩＧ電圧印加後、短時間に発電電圧が立ち上がる場合などにおいて、発電検出しきい値電圧が小さいので素早く発電電圧の立ち上がりを検出することができ、目障りなチャージウオーニングランプを素早く消灯することができる。更に、発電電圧立ち上がり検出後は、発電検出しきい値電圧が高くされるので、発電が励磁電流ではなく残留磁束でなされている場合（例えばロータコイル断線時）などは発電電圧が

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この高い発電検出しきい値電圧より低いので、確実かつ素早くそれを検出してチャージウオーニングランプを点灯し、警報することができる。

【００２４】なお、上記発電検出時間は上記請求項２に記した発明の所定時間と等しくすることができ、上記請求項３に記した発明の所定の電圧値を発電検出しきい値電圧とすることができ、このようにすれば、回路構成の大幅な簡単化、共通化を実現することができる。また、請求項７に記した発明のように励磁の調整をスイッチ手段により行うようにすると、導通率に基づいた発電抑制制御ができるため、制御回路の形成が容易となる。

【００２５】

【実施例】

（実施例１）以下、本発明の一実施例を図１を参照して説明する。まず、主要構成要素を説明する。１は、エンジン（図示せず）駆動の車両用発電機（発電電圧整流用の三相全波整流器７０を有する三相交流発電機）の出力電流制御装置（レギュレータ）であり、車両用バッテリ（バッテリ）３を充電する車両用発電機２の出力電圧（バッテリ３への充電電圧）を所定電圧Ｖｒとするように発電機２のロータコイル（励磁コイル）６へ印加する励磁電圧をスイッチ３４で断続する。レギュレータ１は、イグニッションスイッチ４を通じたＩＧ電圧を電源電圧として給電されており、イグニッションスイッチ４の開放時にスイッチ３４を遮断して、発電機２の発電を停止させる。また、イグニッションスイッチ４が閉じているにも関わらず発電機２の発電電圧が所定レベル以下又は０である場合、すなわちこの実施例では発電機２のステータコイル７の１相電圧Ｖｐの整流値（本発明でいう発電電圧）Ｖｐ’が所定値Ｖｒｐ以下の場合にＴｒ３５を導通させて、チャージウオーニングランプ５を点灯させる。

【００２６】１４は、イグニッションスイッチ４が投入されることにより充電されるコンデンサである。１５は、イグニッションスイッチ４が投入されてから、コンデンサ１４の電圧が所定値に上昇するまでの所定時間（第１の設定時間、約１５０ｍｓ）、トランジスタ（以下、Ｔｒともいう）１６を遮断しておくためのコンパレータである。

【００２７】１９は、ステータコイルの１相電圧Ｖｐの整流値Ｖｐ’が電圧Ｖｒｐを超過した場合にＴｒ２１を遮断することにより、抵抗２０を流れる電流によって充電される第２のコンデンサである。コンデンサ１９の充電電圧Ｖｃは、Ｔｒ１６が導通している場合に所定電圧Ｖｒまで上昇するのに約１０秒（第２の設定時間）の充電時間がかかるように抵抗１７、２０の抵抗値及びコンデンサ１９の容量に依存するＣＲ時定数が設定してある。一方、充電電圧Ｖｃは、Ｔｒ１６が遮断している場合に所定電圧Ｖｒまで上昇するのに約５０ｍｓ（第３の設定時間）の充電時間がかかるように上記時定数が定め

てある。

【００２８】２２は、整流値（発電電圧）Ｖｐ’と所定の電圧Ｖｒｐとを比較する比較器である。電圧Ｖｒｐは発電検出用の比較器２２に与えるしきい値電圧であり、電源電圧Ｖｃｃを抵抗５１、５２で分圧した電圧値である。比較器２２は発電電圧Ｖｐ’が電圧Ｖｒｐを超えた場合に発電検出とし、Ｔｒ２１、３５をオフさせる。ダイオード２４、コンデンサ２３及び抵抗２５は１相電圧Ｖｐを整流する整流回路である。

【００２９】２９は、定デューティーの矩形パルス信号を出力する発振回路であり、Ｈｉレベルの比率（ＯＮデューティ比）は約１０％に設定してある。図面中の符号を付さない抵抗は、トランジスタのベース電流制限抵抗である。次に、他の構成要素を説明しつつこのレギュレータ１の動作を説明する。

（エンジン始動時）エンジン停止状態においてイグニッションスイッチ４を投入すると、発電機２の発電は停止しているために比較器（コンパレータともいう）２２の出力はＨｉとなり、Ｔｒ３５を導通させ、チャージランプ５を点灯させる。

【００３０】また、Ｔｒ２１も導通するため、充電電圧ＶｃがＬｏとなり、比較器３０の＋入力は－入力すなわち所定電圧Ｖｒより低くなり、比較器３０はＬｏをオア回路３１へ出力する。これにより、ＯＲ回路３１の出力は発振回路２９から出力されるパルス波形と等しくなる。２８は、バッテリ電圧の分圧Ｖａと所定電圧Ｖｒとを比較する比較器であり、発電機２が発電していないこの場合には、比較器２８はＨｉをアンド回路３２に出力し、ＡＮＤ回路３２は発振回路２９から出力される上記パルス波形をＴｒ（スイッチ）３４のベースに印加し、Ｔｒ３４は上記パルス波形と同期して導通し、ロータコイル６に励磁電圧を間欠的に印加する。すなわち、エンジン停止状態においてイグニッションスイッチ４を投入すると、上記パルス波形に同期する導通率で励磁電圧がロータコイル６に印加される。

【００３１】次に、イグニッションスイッチ４の投入後、このレギュレータ１の電源電圧Ｖｃｃは１ｍｓ程度の時間で上昇し、それに応じて抵抗４３と定電圧ダイオード１２との接続点の電圧が一定レベルとなり、Ｔｒ１１が導通し、コンデンサ１４が抵抗１３を通じて充電される。比較器１５は、抵抗４１、４２からなる分圧回路が出力する電源電圧Ｖｃｃの分圧と、コンパレータ１４の充電電圧Ｖｃ’とを比較し、充電電圧Ｖｃ’がＨｉとなればＴｒ１６をオンさせる。ここでは、抵抗４１、４２、１３及びコンデンサ１４の容量は、イグニッションスイッチ４の投入後、約１５０ｍｓで比較器１５の出力がＨｉに反転し、Ｔｒ１６を導通するように設定している。

【００３２】更に、Ｔｒ１６がイグニッションスイッチ４の投入から、約１５０ｍｓ遅延してオンする意味を以下に説明する。すなわち、エンジン始動時においてイグニッションスイッチ４の投入と同時にエンジンを始動させたとしても、スタータによるエンジンのクランキング時間は、一般的に２００ｍｓ以上である為、発電機２の発電を検出し、比較器２２の出力がＬｏとなる前に、Ｔｒ１６は導通状態となっている。

【００３３】従って、エンジン始動時には、発電電圧Ｖｐ’が電圧Ｖｒｐを超えて比較器２２により発電検出すればトランジスタ２１がオフする前にＴｒ１６がオンするので、トランジスタ２１のオフ後にコンデンサ１９は抵抗２０でのみ充電され、基準電圧Ｖｒまで充電されるのに約１０ｓが必要となる。この充電時間内は、比較器３０の出力はＬｏとなり、上記パルス波形がＴｒ３４に印加され、ロータコイル６の平均励磁電圧は上記パルス波形のＯＮデューティ比と同じく１０％一定となり、発電機２の発電が抑制され、始動直後のエンジンに対して過度のトルクが加わらない。

【００３４】一方、イグニッションスイッチ４の投入後、１０ｓ以上経過すれば、抵抗２０によりコンデンサ１９の充電電圧Ｖｃが所定電圧Ｖｒ以上となって、比較器３０の出力がＨｉとり、ロータコイル６は比較器２８の出力電圧により制御される。すなわち、比較器２８は所定電圧Ｖｒとバッテリ電圧の分圧Ｖａとを比較して、その比較出力により、スイッチ３４が開閉されてバッテリ電圧の分圧Ｖａが所定電圧Ｖｒになるように制御される。

【００３５】なお、所定電圧Ｖｒは目標バッテリ電圧の分圧であって、電源電圧Ｖｃｃの分圧である。電源電圧Ｖｃｃは抵抗４３を無視すれば、抵抗１０とトランジスタ１１のベース・エミッタ間電圧と定電圧ダイオード１２との直列接続回路からなる定電圧回路の出力電圧であり、ＩＧ電圧の変動に関わらず安定化されている。

（出荷検査）次に、発電機２の製品出荷時の出荷検査作業を説明する。

【００３６】発電機２の回転数を定格回転数（５０００ｒｐｍ）とした状態でイグニッションスイッチ４を投入すると、上記説明したエンジン始動時と同様にロータコイル６には発振回路２９からのパルス波形と同期した励磁電圧が印加される。一般に、ロータコイル６の時定数（通電電流の位相遅れ、約１５０ｍｓ）程度の時間があれば、発電機２の一相電圧Ｖｐはバッテリ３の電圧以上になる。所定値（発電検出しきい値）Ｖｒｐを適当に選ぶことによりイグニッションスイッチ４の投入後、１００ｍｓ以内に発電を検出できる。

【００３７】なお、この発電検出時点では、コンデンサ１４はほとんど充電されておらず充電電圧Ｖｃ’がＶｒ以下であるので、Ｔｒ１６は遮断しており、抵抗１７からの充電電流の追加によりコンデンサ１９の充電時間は５０ｍｓとなり、その結果、イグニッションスイッチ４の投入後１５０ｍｓ以内に比較器３０の出力はＨｉとな

り、ロータコイル6を100%のONデューティ比（バッテリ電圧の分圧Vaが所定電圧Vrより低い場合）で励磁可能となり、短時間で発電機2の最大出力の検査が可能となる。

【0038】（エンジン回転時）次に、エンジン回転時の動作を説明する。エンジン及び発電機2の回転中にイグニッションスイッチ4を一度断として再度投入する場合、又は、何らかの原因でレギュレータ1に印加されるIG電圧が一時的に大幅に低下してレギュレータ1がその後のIG電圧上昇をイグニッションスイッチ4の投入と判断する場合（レギュレータ1がイグニッションスイッチ4の投入時と同じ動作を行う場合）、エンジン及び発電機2の回転中のイグニッションスイッチ4の投入であるので実質的に上記した出荷検査時と同じ制御動作が行われる。

【0039】すなわち、イグニッションスイッチ4の投入後、150ms以内に比較器30の出力はHiとなり、スイッチ34の導通率制限を早期に解除することができる。

（実施例2）第2実施例をレギュレータ1の要部を示す図2を参照して説明する。図3は図2のレギュレータ1のタイミングチャートである。

【0040】本実施例の特徴点を列記する。この実施例は実施例1のコンデンサ積分方式をカウンタ方式としたものである。すなわち、この実施例では、比較器22による発電検出時点から100%（バッテリ電圧低下時）でのロータコイル6の励磁（導通率制限の解除）時点までの導通率制限時間を定めるコンデンサ19をn段バイナリカウンター108に変更したものである。

【0041】また、実施例1においてIG電圧印加からの所定時間（第1時間）を定めるコンデンサ14を、IG電圧印加時に発生するトリガパルスTGPでセットされるホールド回路104に変更している。ホールド回路104は、IG電圧印加後の所定の遅れ時間（150msec）経過後に発生するトリガパルスCK2によってリセットされる。

【0042】更に、IG電圧印加時点から前記所定の遅れ時間（第1時間）経過した後、NOT回路105の出力をHiとすることにより、発電検出しきい値を所定値Vrpからより大きな所定値Vrphに変更している。なお、所定値Vrpはスイッチ34が遮断している場合にロータコイル6の残留磁束によって発生するステータ7の1相電圧Vpの整流値Vp'より小さく設定されており、所定値Vrphは前記残留磁束によって発生するステータ7の1相電圧Vpの整流値Vp'より大きな値に設定されている。

【0043】電源電圧Vccは、抵抗120を無視すれば定電圧ダイオード101とトランジスタ102のベース・エミッタ間電圧と抵抗10とによる定電圧回路により決定される。コンデンサ100はIG電圧より電源電圧Vccを僅かな時間遅延させて、カウンタ108やホールド回路104の初期トリガパルスTGPを形成するためのものである。

【0044】以下、他の構成及び動作を説明する。（IG電圧印加時）IG電圧がレギュレータ1のIG端子に印加されると、上記コンデンサ100などによる遅延によりTr102が導通するまでの短時間（図3参照）だけ節点CKOは抵抗121により充電されてHiとなり、初期トリガパルスTGPがホールド回路104のセット端子Sに入力されてそのQ出力がHiにセットされ、また、カウンタ108のリセット端子R2に入力されて、カウンタ108のカウント値が2^nの値にリセットされる。ホールド回路104のQ出力がHiとなると、NOT回路105の出力はLoとなり、ラインLの電圧は低い所定値Vrp（ここでは2V）となり、比較器22の発電検出しきい値電圧はこの低いVrpとなる。

【0045】また、ホールド回路104のリセット端子Rにはクロック回路110からのパルスCK2が定期的に入力されるが、このパルスCK2は図3に示すように長周期（150msec）とされている。したがって、IG電圧が入力してから所定時間（第1時間）150msecが経過するまでは、アンド回路107はLoを出力し、カウンタ108のリセット端子R1にはリセット信号Hiが入力されることはない。

【0046】（エンジン回転時、発電電圧の立ち上がり速度が速い場合）エンジンが回転しており、IG電圧印加後の所定時間以内（ここでは150ms、すなわちホールド回路104がセットされている期間）に整流値Vp'が立上ると、比較器22の出力はLoとなり、チャージウオーニングランプ5が消灯されるとともにNOT回路113の出力がHiとなって、クロック発生回路111から出力されるパルスCK1のタイミングでカウンタ108はカウント値2^nからカウントをアップする。この時、NOT回路109の出力は当然、Hiとなっている。

【0047】クロック発生回路111のパルスCK1によりカウンタ108のカウント値がカウントアップして2^0となると、カウンタ108のQ出力はHiとなり、NOT回路109の出力がLoとなって、アンド回路112の出力をLoとしてカウントアップを停止させ、カウント値は2^0のままとなる。同時に、OR回路31の出力がHiとなってロータコイル6を100%のONデューティ比で励磁可能とする。更に、NOT回路106の出力がLoとなり、これにより150msecが経過してパルスCK2がアンド回路107に入力してもリセット端子R1にHiが入力されないようにする。

【0048】すなわち、この場合には、整流値Vp'の急速な立ち上がりを検出してスイッチ34の導通率制限を150msec後に解除して、速やかなバッテリ強力

充電を実現している。なお、ＩＧ電圧印加後１５０ｍｓ経過すると、図３に示すようにクロック回路１１０からのパルスＣＫ２がホールド回路１０４のリセット端子Ｒに入力し、ホールド回路１０４のＱ出力がＬｏとなり、ＮＯＴ回路１０５がＨｉを出力し、ラインＬの電圧が高い所定値Ｖｒｐｈ（ここでは１０Ｖ）となり、比較器２２の電圧検出しきい値（＋入力端電圧）が高く設定される。

【００４９】このようにすれば、ＩＧ電圧印加直後（１５０ｍｓｅｃ後）には発電電圧の僅かな立ち上がりにより素早く発電電圧の立ち上がりを検出することができるとともに、エンジンの回転中ではしきい値電圧が増大するのでたとえロータコイル６の断線などで残留磁化により発電電圧が生じていても確実に比較器２２が発電停止（Ｈｉ）を出力して、確実にチャージランプ５を点灯できる。

（エンジン始動時、発電電圧の立ち上がり速度が遅い場合）発電の立上りの検出が（すなわち比較器２２がＬｏになるのが）、ＩＧ電圧印加後、１５０ｍｓ以上経過後になる場合を説明する。

【００５０】比較器２２が整流値Ｖｐ’の立ち上がりを検出することなく、ＩＧ電圧印加後１５０ｍｓ経過すると、図３に示すようにクロック回路１１０からのパルスＣＫ２がアンド回路１０７に入力され、この時、ノット回路１０６及びホールド回路１０４はＨｉを出力しているのでカウンタ１０８のカウント値は2^1にリセットされる。

【００５１】また、パルスＣＫ２はホールド回路１０４のリセット端子Ｒに入力し、ホールド回路１０４のＱ出力をＬｏにリセットする。これにより、ノット回路１０５はＨｉになり、比較器２２のしきい値は所定値Ｖｒｐｈに増大される。その後、エンジン始動により整流値（発電電圧）Ｖｐ’が上昇して所定値Ｖｒｐｈ以上となると、比較器２２はＬｏとなり（発電を検出し）、カウンタ１０８はパルスＣＫ１のタイミングでカウントアップをし、2^1の値から（2^n－１）回の長いカウントアップを行って2^0の値となり、2^0になった後は、アンド回路１１２がＬｏを出力し、カウンタ１０８のカウントアップが終了し、オア回路３１及びＮＯＴ回路１０６にＨｉ電圧が出力される。なお、ここでは１０４にＳ優先ＦＦを用い、１１０にワンショットマルチバイブレータを用いている。

【００５２】従ってこの場合には、パルスＣＫ１の周期（T_1）の（2^n－１）倍の時間が経過するまでは、スイッチ３４の導通率を発振回路２９のＯＮデューティ比で制限できる。したがって、この場合には、比較器２２が発電を検出した時点までチャージウオーニングランプ５は点灯されている。

【００５３】以下、エンジン回転時のチャージウオーニングランプ５の点灯制御について更に説明する。ＩＧ電圧印加時から所定時間（１５０ｍｓ）内、すなわちホールド回路１０４の出力がＨｉにセットされている場合は、ＮＯＴ回路１０５の出力がＬｏとなって、ＮＯＴ回路１０５が抵抗１２３を通じてラインＬから電流を吸収してラインＬの電圧を低い所定値Ｖｒｐとし、これにより比較器２２の発電検出しきい値を低い所定値Ｖｒｐにすることで、発電機２の回転中にＩＧ電圧を印加した場合に発電機２の発電がこの低い所定値Ｖｒｐに立上るまでの僅かな時間（１００ｍｓ以内）だけしかチャージウオーニングランプ５が点灯しないようにしている。

【００５４】一方、発電立ち上がり（１００ｍｓ以内）後、クロック回路１１０により定まる第１時間（１５０ｍｓ）経過後は、比較器２２のしきい値電圧が高い所定値Ｖｒｐｈとなるので、もし励磁電流ではなく残留磁化により発電しているのであれば発電電圧Ｖｐ’が小さく、比較器２２がＨｉとなるので、それを検出してチャージウオーニングランプ５を点灯することができる。

【００５５】なお、上記実施例では、ハードウエア電子回路で構成したが、同一機能を有する他のハードウエア電子回路やマイコン回路を用いて構成することもできる。ちなみに、実施例１において、２８は発電電圧調整手段の要部を構成し、２９は導通率制限手段の要部を構成し、２２は、導通率制限抑制手段の一部であって、ＩＧ電圧印加後の発電電圧の立ち上がりが速いかどうかを検出する部分、２１は、導通率制限抑制手段の一部であって、立ち上がりが速い場合に導通率制限手段による導通率制限を抑制する部分である。

【００５６】また、実施例２において、２２は、発電検出手段の要部を構成し、ホールド回路１０４及びＮＯＴ回路１０５はしきい値変更手段の要部を構成している。

【図面の簡単な説明】

【図１】実施例１の装置を示す回路図である。

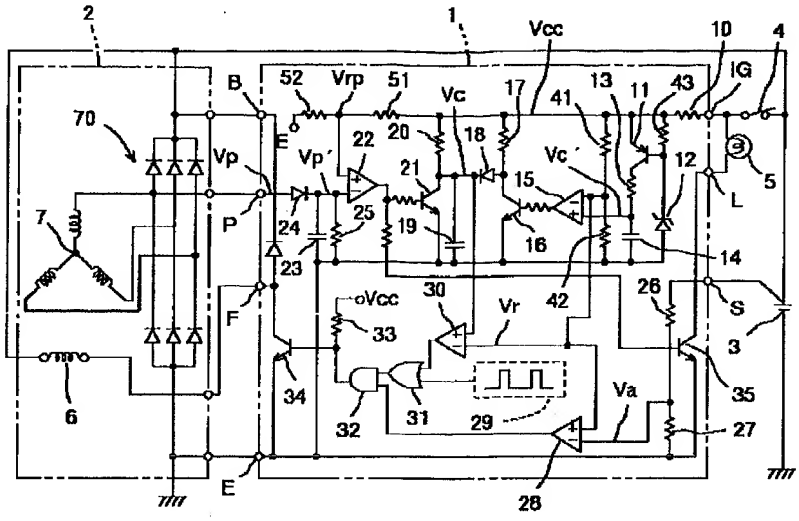
【図２】実施例２の装置を示す回路図である。

【図３】図２の各部電圧波形を示すタイミングチャートである。

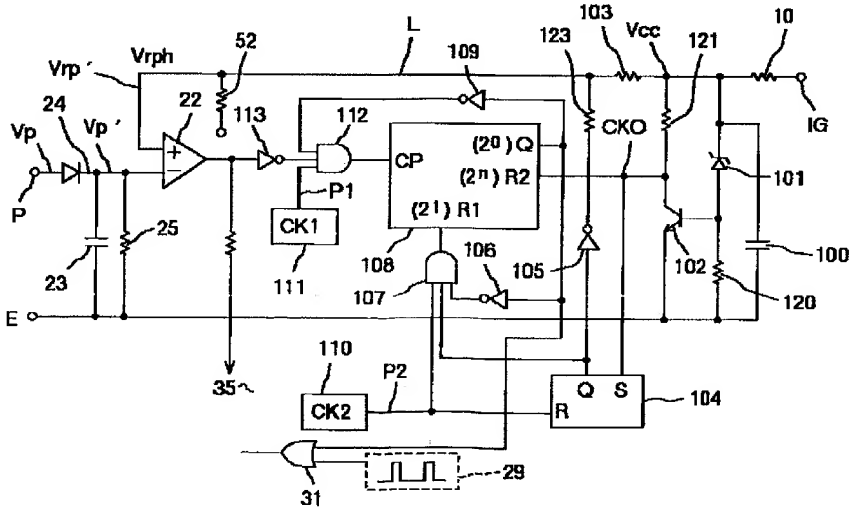
【符号の説明】

１は車両用発電機の出力電流制御装置（レギュレータ）、２は車両用発電機、３はバッテリ、４はイグニッションスイッチ、２８は比較器（発電電圧調整手段）、２９は発振回路（導通率制限手段）、２１はトランジスタ、２２は比較器、２１、２２は導通率制限抑制手段、１０４はホールド回路、１０５はＮＯＴ回路、１０４、１０５はしきい値変更手段。

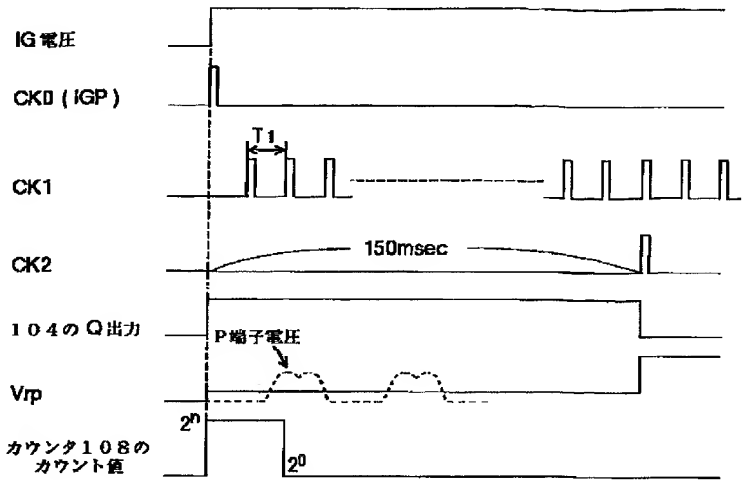
【図1】


2
1
Vcc
10
4
B
52
Vrp
51
Vc
17
41
13
11
43
IG
70
Vp
E
22
20
18
Vc'
Vp'
21
15
12
5
L
7
P
24
25
19
16
14
23
F
oVcc
30
Vr
42
26
S
33
3
6
34
32
31
29
Va
35
27
E
28

【図2】


L
103
123
Vcc
121
10
Vrp'
Vrph
52
109
IG
24
22
113
112
CKO
Vp
Vp'
CP
(2⁰) Q
(2ⁿ) R2
101
P
P1
(2¹) R1
25
CK1
108
106
105
102
100
23
111
107
120
E
110
35
P2
Q
S
CK2
R
104
31
29

【図3】


IG電圧
CK0（IGP）
T1
CK1
150msec
CK2
104のQ出力
P端子電圧
Vrp
2^n
2^0
カウンタ108の
カウント値